REMARKS

Claims 1-41 have been cancelled.

New claims 42-60 have been added.

Applicant wishes to thank Examiner Clardy for the recent helpful and courteous discussion conducted with his representative, Mr. William E. Beaumont. During the discussion, the use of ammoniating and nitrifying liquors by Woodhouse was emphasized with the resulting production of ammonium sulfamate in contrast to the presently claimed invention as reflected in claims 42-60.

The present invention provides a ready-to-use composition for adjusting macronutrient or micronutrient concentrations or both in a medium for growing plants. See claims 51-55. It also provides a method for correcting macronutrient or micronutrient deficiencies or both in a medium for growing plants, as well as a method for forming a macronutrient- or micronutrient-adjusting or both, ready-to-use composition. See Claims 42-50, and 56-60, respectively.

Claims 27, 28, 31-33, 36-38 and 41 stand rejected under 35 U.S.C. §102(a), (b) and (e) as being anticipated by Woodhouse (U.S. 2,237,826).

However, Woodhouse fails to either disclose or suggest any of the subject matter of present claims 42-60.

Notably, Woodhouse merely describes the incorporation of sulfamic acid into nitrogen-containing or ammoniating liquors in order to adjust the ratio of fixed to free ammonia to be varied over a wide range. Col. 2, lines 30-34. Further, while Examples 1 and 2 at col. 4, lines 60-75 describe the addition of ammonium sulfamate, it is equally clear that addition of free sulfamic acid to the ammoniating or nitrifying solutions described in U.S.

1,894,136 (See Col. 2, lines 41-55) would neutralize the sulfamic acid by formation of the ammonium salt as Woodhouse describes the ammoniating or nitrifying solutions as:

> ...containing both inorganic and organic ammonia. Col. 2, lines 51-52.

Clearly, one skilled in the art would expect formation of ammonium sulfamate in an acid-base reaction.

As evidence thereof, it is noted that sulfamic acid has a reported pKa valve of 0.99, and ammonia has a pKb value of 9.25, i.e., acid and base, respectively. See the attachments, www.swbic.org/education/env-engr/chem/acidconstants.html and home.planet.nl/~skok/techniques/laboratory/pka__pkb.html.

In contrast, the present invention is based, at least in part, upon the use of sulfamic acid or a compound based on sulfamic acid, having, in all cases, a free acidic hydrogen bonded to the S atom. This is necessary for subsequent reaction of this portion of the molecule with Ca^{+2} or Mg^{+2} or both cations, for example.

An important consequence of ammonium sulfamate formation from metallic salts of sulfamic acid (mostly bivalent cation sulfamate), e.g., calcium, magnesium, iron, manganese, copper, zinc, cobalt and nickel sulfamates, is the displacement reaction of metal from the sulfamate by the more reactive monovalent ammonium. The formation of ammonium sulfamate from metallic salts of sulfamic acid displaces metal from metallic sulfamates throughout their use as nitrifying agent in Woodhouse.

In fertilizer mixtures containing sulfates and phosphates and metallic salts of sulfamic acid, the bivalent anions form substantially stronger bonds to metallic bivalent cations from the salt of sulfamic acid than the monovalent sulfamate anion, resulting in metal precipitation, e.g., a solution containing

calcium sulfamate and sulfate precipitates calcium sulfate. As metallic micronutrients are added in small quantities to fertilizer mixtures, any metallic precipitation will deplete the mixture of its essential micronutrients and fundamentally alter the composition.

As noted above, Woodhouse describes the addition of a nitrifying agent which increases the formation of ammonium-containing phosphate (p.1, left col., lns 52-55, p. 1, right col., lns 1-5). Thus, Woodhouse adds nitrifying agent to increase reactions that require ammonium-containing sulfamate rather than metallic-containing sulfamate. Thus, arguendo, even if Woodhouse is considered to describe a fertilizer, Woodhouse clearly teaches away from the present ready-to-use combination by destabilizing it or by making it less full of essential metals, either by displacement reaction or by precipitation of metals from metallic sulfamate.

As noted during the discussion with Examiner Clardy, the presently claimed subject matter relates to a ready-to-use composition and the preparation and use thereof in treating macronutrient or micronutrient deficiencies in a growing medium for plants. This may clearly be seen, for example, from Examples 1-3 at pages 27-29, paragraphs [0068]-[0071] of the present specification, where the prepared composition is applied directly to the soil.

In more detail, the presently claimed ready-to-use composition is prepared based upon determined deficiencies in macronutrient or micronutrient concentrations or both in a medium for growing plants, such as soil or a hydroponic medium, for example. The deficiencies are, thus, first determined, and

the composition is prepared specifically with the measured deficiencies in mind in the form of a ready-to-use composition.

Clearly, Woodhouse fails to either disclose or suggest the preparation or use of ready-to-use mixtures for correcting macronutrient or micronutrient deficiencies or both in a medium for growing plants. To the contrary, Woodhouse describes the preparation of bulk fertilizer compositions which are not intended for use "as is". For example, each of Examples 1, 2 and 3 describes the preparation of a bulk fertilizer, preparations commencing with an excess of 3,000 lbs. of commercial superphosphate (Examples 1 and 2) or 1,000 lbs. of fertilizer base (Example 3).

Clearly, one skilled in the art would be neither motivated nor enabled from Woodhouse to attain the subject matter of present claims 42-60.

Hence, this ground of rejection is unsustainable and should be withdrawn.

Claims 32-36 stand rejected under 35 U.S.C. §102(a) and (b) as anticipated by Kirk-Othmer.

However, this reference fails to either disclose or suggest any of the presently claimed subject matter.

Notably, the mere description of reactions forming "various metal sulfamates" by reacting sulfamic acid with carbonates, oxides or hydroxides would neither have disclosed nor suggested the subject matter of any of the present claims to one skilled in the art at the time the present invention was made.

Hence, this ground of rejection is believed to be unsustainable and should be withdrawn.

Claims 32 and 34-36 stand rejected under 35 U.S.C. §102(a), (b) and (e) as being anticipated by Fischer (U.S. 3,321,273).

However, this reference neither discloses nor suggests any of the presently claimed subject matter.

Specifically, the mere description of methods of making metal sulfamate compositions by reacting metals (Ni, Co, Fe, Pb, Cu, Cd, Zn and Al) with sulfamic acid would neither have disclosed nor suggested the subject matter of any of the present claims to one skilled in the art at the time the present invention was made.

If necessary, please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

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Acids and Bases: pKa and pKb

What's on this page?

- Click here for theory about pH
- Browse direct to the Table of pKa values for acids or Table of pKb values for bases. (Legend at the bottom of this page).
- A list of commonly used HPLC-buffers with their working range and UV cutoff as well as other links to buffer-sites can be found elsewhere on the Laboratory-pages.

pH theory

The relationship between pH, pKa, and the relative concentrations of an acid and its salt is as follows:

$$pH = pK_a + \log\frac{[A^-]}{[HA]}$$

$[A^-]$ the molar concentration of the salt (dissociated species)
[HA] the concentration of the undissociated acid
When the concentrations of the salt and acid are equal, the pH of the system equals the pKa of the acid.

The percentage ionisation from a given pKa value can be calculated at Reall.

pKa and pKb tables

Make your choice: Table of pKa values for acids or Table of pKb values for bases. Click here for the abbreviations used in the tables. You can always return to this index by mouse-double click.

Acids	T(°C)	pKa	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Acetic acid	25	4.75															
ACES	20	6.90															
ADA	20	6.60															
Benzoic acid	25	4.20															
Bicine	20	8.35															
BIS-TRIS Propane	20	6.80															
o-Boric acid (1)	20	9.14															
o-Boric acid (2)	20	12.74															
o-Boric acid (3)	20	13.80															
Carbonic acid (1)	25	6.37															
Carbonic acid (2)	25	10.25															
CAPS	20	10.40															
CHES	20	9.50															
Citrate (1)	25	3.13															
Citrate (2)	25	4.76															
Citrate (3)	25	6.40															
Acids	**T(°C)**	**pKa**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Diethylmalonic acid	-	7.20															
Formic acid	20	3.75															
Glycylglycine	20	8.40															
HEPES	20	7.55															
HEPPS	20	8.00															
Imidazole	20	7.00															
MES	20	6.15															
MOPS	20	7.20															

PIPES	20	6.80
Phenol	20	9.99
o-Phosphoric acid (1)	25	2.12
o-Phosphoric acid (2)	25	7.21
o-Phosphoric acid (3)	25	12.67
POPSO	-	7.85
Succinic acid (1)	-	4.19
Succinic acid (2)	-	5.57
TAPS	25	8.40
TES	20	7.50
Tricine	20	8.15
TRIS	20	8.30

Bases	**T(°C)**	**pKb**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Ammonia	25	9.25															
Aniline	25	4.63															
Benzylamine	25	9.33															
n-Butylamine	20	10.78															
Diethylamine	20	11.09															
Dimethylamine	25	10.73															
Diphenylamine	25	0.79															
Ethylenediamine	20	10.81															
Ethylenediamine (1)	20	10.08															
Ethylenediamine (2)	20	6.99															
Methylamine	25	10.66															
N-Methylaniline	25	4.85															
Morpholine	25	8.33															
Pyridine	25	5.21															
Triethylamine	18	11.01															
Trimethylamine	25	9.81															

Abbreviations

ACES 2-[(2-amino-2-oxoethyl)amino]ethanesulphonic acid
ADA N-(2-acetamido)-2-iminodiacetic acid
BES N,N-bis(2-hydroxyethyl)-2-aminoethanesulphonic acid
BICINE n,n-bis(2-hydroxyethyl) glycine
BIS-TRIS-Propane 1 ,3-bis[tris(hydroxymethyl)methylamino] propane
CAPS 3-(cyclohexylamino) propanesulphonic acid
CHES 2- (cyclohexylamino) ethanesulphonic acid
HEPES N-2-hydroxyethylpiperazine-N'-2-ethane-sulphonic acid
HEPPS N-2-hydroxycthylpipcrazine-N'-3-propane-sulphonic acid
MES 2-(N-morpholino) ethanesulphonic acid
MOPS 3-(N-morpholino) propanesulphonic acid
PIPES piperazine-N-N'-bis (2-ethanesulphonic acid)
POPSO piperazine-1,4-bis(2-hydroxypropanesulfonic acid)
TAPS 3-[tris (hydroxymethyl) methyl] amino propanesulphonic acid
TES 2-[tris (hydroxymothyl) methyl] amino ethanesulphonic acid
Tricine N-[tris (hydroxymethyl) methy] glycine
TRIS tris (hydroxylmethyl) aminomethane

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Acid-Base Equilibrium Constants (25°C)

Acid	*Formula*	*n*	*pK1*	*pK2*	*pK3*	*pK4*
Acetic	CH_3COOH	1	4.757			
Ammonium	NH^{4+}	1	9.244			
Antimonic	H_5SbO_5	1	2.72			
Arsenic	H_3AsO_4	3	2.24	6.96	11.5	
Arsenous	H_3AsO_3	1	9.26			
Benzoic	$C_7H_6O_2$	1	4.20			
Boric	H_3BO_3	1	9.24			
Butyric	$CH_3CH_2CH_2COOH$	1	4.82			
Caproic	$CH_3CH_2CH_2CH_2COOH$	1	4.86			
Carbonic	H_2CO_3	2	6.35	10.33		
Chloracetic	$C_2H_3O_2Cl$	1	2.86			
Chlorophenol (4-)	C_6H_5OCl	1	9.43			
Chlorous	H_1ClO_2	1	1.95			
Chromic	H_2CrO_4	2	-0.2	6.51		

Perchloric	$HClO_4$	1	-7			
Phenol	C_6H_5OH	1	9.98			
Phenylacetic	$C_8H_8O_2$	1	4.31			
Phosphoramidic	H_4NPO_3	2	3.08	8.63		
Phosphoric	H_3PO_4	3	2.15	7.20	12.38	
Phosphorous	H_3PO_3	2	1.5	6.78		
Propionic	CH_3CH_2COOH	1	4.87			
Pyrophosphoric	$H_4P_2O_7$	4	.8	2.31	6.69	9.42
Selenic	H_2SeO_4	2	0	1.7		
Selenosulfuric	H_2SSeO_3	1	0.99			
Selenous	H_2SeO_3	2	2.63	8.4		
Silicic	H_4SiO_4	2	9.84	13.2		
Sulfamic	H_3NSO_3	1	0.99			
Sulfuric	H_2SO_4	2	-3	1.99		
Sulfurous	H_2SO_3	2	1.86	7.19		
Telluric	H_6TeO_6	2	7.66	11		
Tellurous	H_4TeO_4	2	0	8.60		